

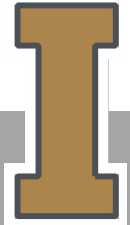
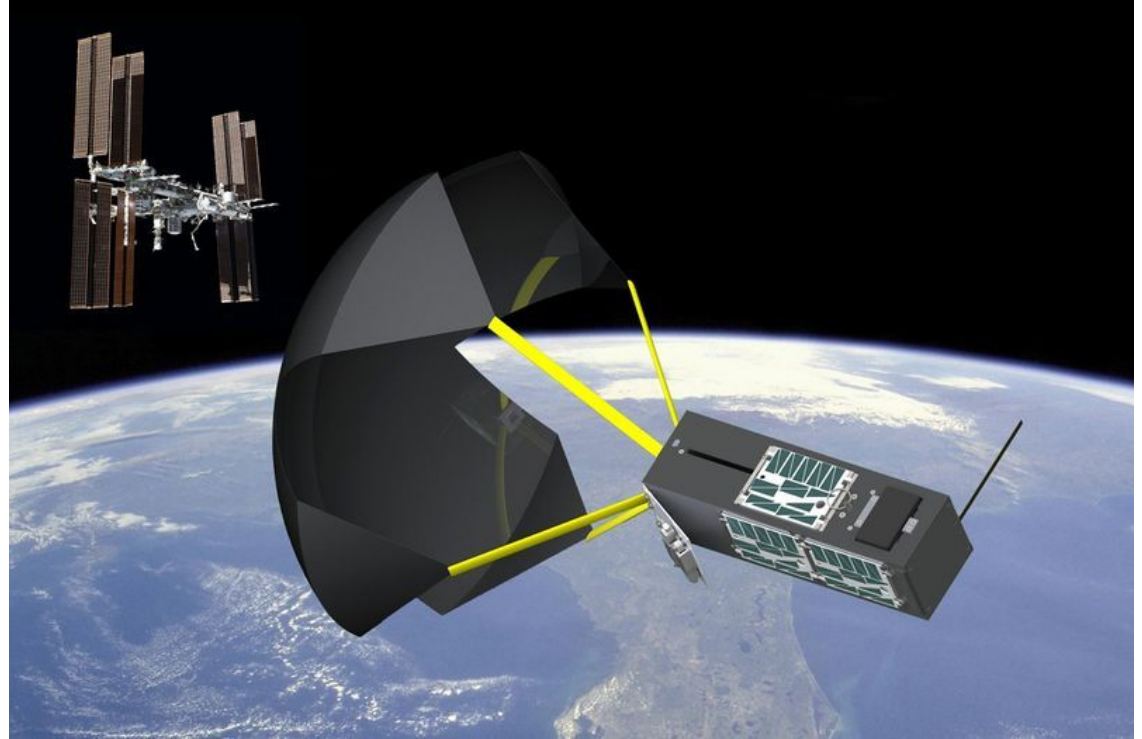
Iridium 9523 Satellite Modem Development Platform and Integration

Tessa Aus, David Handy, Jonathan Hanson, Jordan Lynn, Chris Ocker



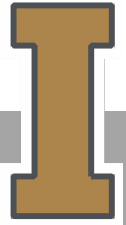
Outline

- Objective
- Specifications
- System Design
- Outcomes
- Going Forward



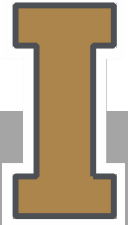
Acronyms

- HAB - High-Altitude Balloon
- IP - Internet Protocol
- LED - Light Emitting Diode
- LOC - Lines of Code
- PCB - Printed Circuit Board
- PPP - Point-to-Point Protocol
- SBD - Short Burst Data
- SIM - Subscriber Identity Module
- TCP - Transmission Control Protocol
- TES - TechEdSat
- TTL - Transistor-Transistor Logic
- 9523 - Iridium 9523 Modem



Objective

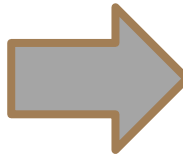
- Design Dial-Up Data System for Planetary Probes
- Interface with Iridium 9523
 - Required Hardware
 - Software Libraries
- Demonstrate on Near-Space Flight
- Integrate with TechEdSat



Deliverables

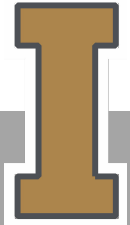
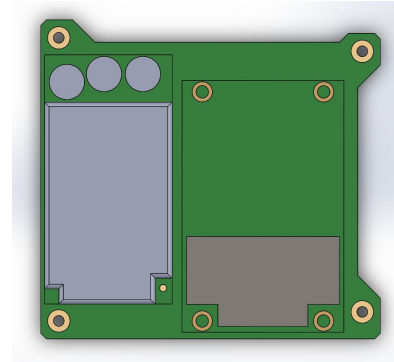
Development

- 9523 Breakout PCB
- 9523 General Software Library
- Flight Software Documentation



Integration

- CubeSat Comms PCB
- TechEdSat Flight Software



Specifications



Software Specs

- Commented Libraries for 9523
- Portability
- Standardized Documentation
- Cyclomatic Complexity ~12
- Streaming Data



Interface Operation

public interface **Operation**

Simple calculator operation.

Version:

1.0

Author:

[Me](#)

Method Summary

void	calculate (double operand) Perform a single calculation.
double	getResult () Get the current result.

Method Detail

calculate

void **calculate**(double operand)

Perform a single calculation.

Parameters:

operand - the operand to use for calculation.

getResult

double **getResult**()

Get the current result.

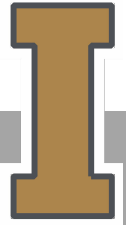
Returns:

the current result. If no calculations were performed the result is undefined.

[Package](#) [Class](#) [Tree](#) [Deprecated](#) [Index](#) [Help](#)

Hardware Specs

- Breakout 9523 Interface
 - Power - 5V In, 27V Boost
 - Data - TTL Serial
 - SIM Card
- LED Visual Feedback
- Minimize Area
 - Cost
 - HAB Flight Ready

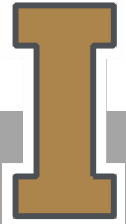
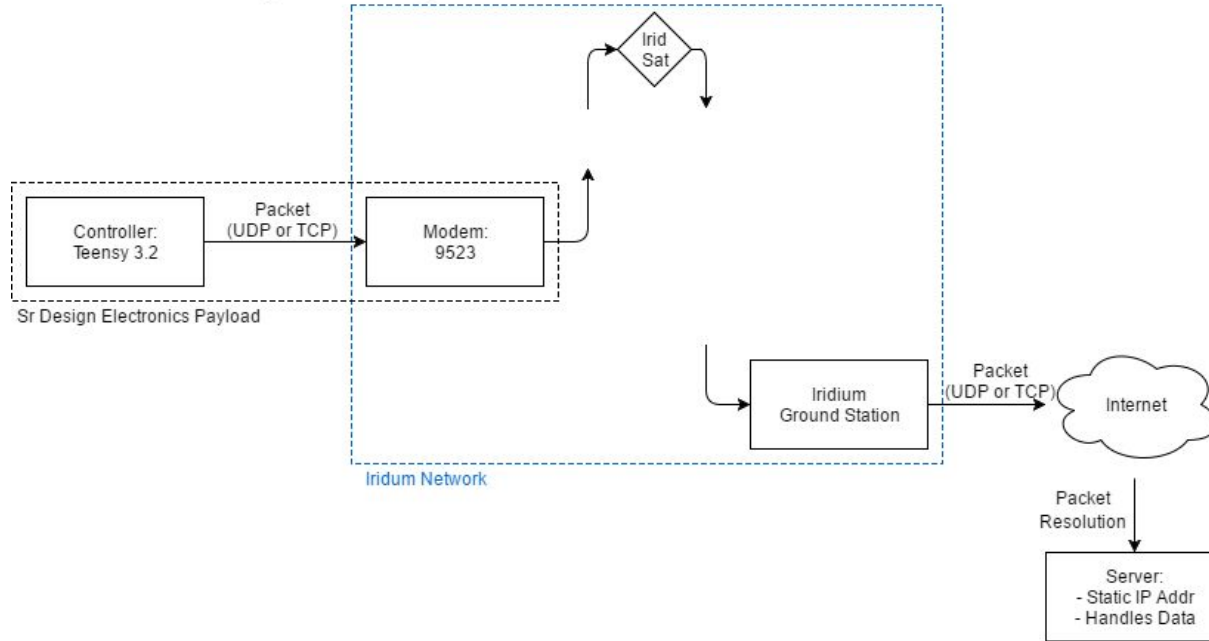


System Design



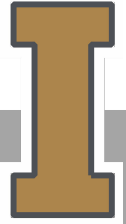
Block Diagram

Team Rocket Senior Design Data Flow Diagram



Throughput

- SBD for 1 min
 - 5s reliable interval
 - 270 B /packet
 - \$0.42 /packet
 - 3240 B for \$5.04
- Dial-Up for 1 min
 - 2.4 kbps
 - \$0.92 /min
 - 18000 B for \$0.92



Outcomes



Iridium Software Library

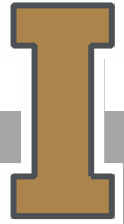
- Standardized Documentation
- Packaged in a Library
- Backward Compatible with 9602
- PPP server on Teensy
- TCP/IP implemented on Teensy



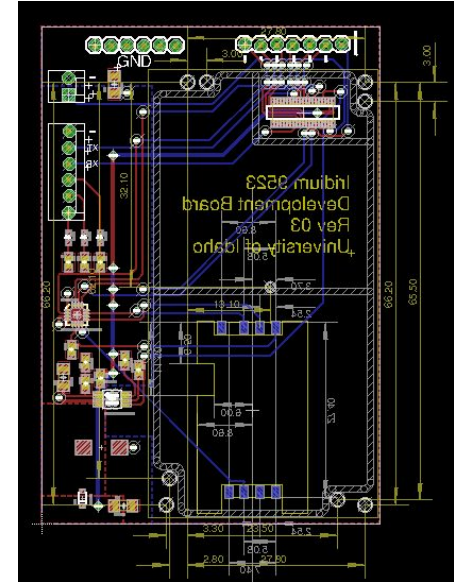
State of the Code

- Cyclomatic Complexity of 15
- Comments to LOC ratio of 1:2.1

	Tag	Overall	Per Module
Number of modules	NOM	16	
Lines of Code	LOC	1223	76.437
McCabe's Cyclomatic Number	MVG	245	15.312
Lines of Comment	COM	572	35.750
LOC/COM	L_C	2.138	
MVG/COM	M_C	0.428	
Information Flow measure (inclusive)	IF4	49	3.062
Information Flow measure (visible)	IF4v	9	0.562
Information Flow measure (concrete)	IF4c	36	2.250
Lines of Code rejected by parser	REJ	73	

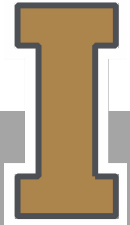
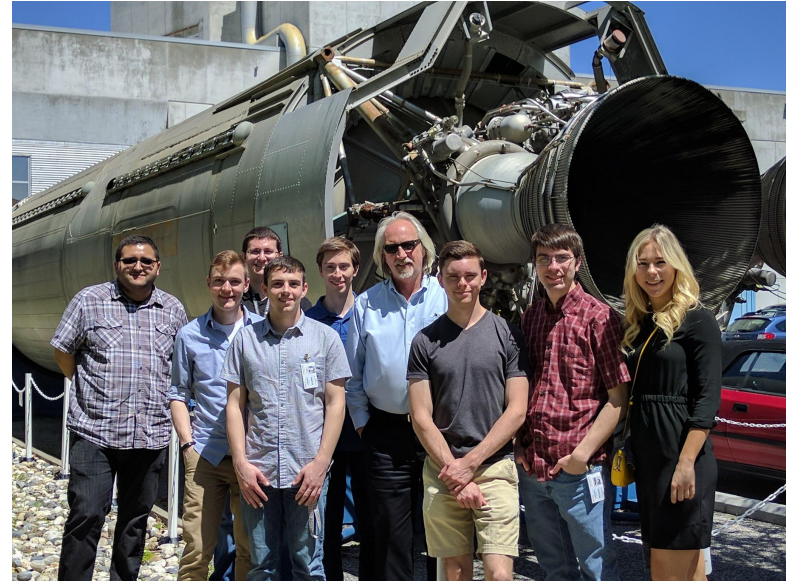


- [illegible]



A3LA-RS Testing

- Teensy with Arduino IDE
 - Successful Dial-Up
 - Connection Refused
- Serial Terminal Emulator
 - Successful Dial-Up
 - Connection Refused
- PPP Server
 - Windows and Linux Tested
 - Modem Unresponsive



Questions?

